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TC 1700

PATENT
Customer No. 22,852
Attorney Docket No. 08513.7023-00000



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of:

Holmes et al.

Serial No.: 09/529,873

Filed: July 27, 2000

For: POLYMERIC MATERIALS FOR
ELECTROLUMINESCENT DEVICES

Group Art Unit: 1711

Examiner: D. Truong

Commissioner for Patents
Washington, DC 20231

Sir:

TRANSMITTAL LETTER

Enclosed are the following:

☒ Response to Examiner's Action

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: November 5, 2002

By: Therese A. Hendricks
Therese A. Hendricks
Reg. No. 30,388

HEREBY CERTIFY THAT THIS CORRESPONDENCE IS DEPOSITED
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DATE

Therese A. Hendricks
THERESE HENDRICKS

In applicant's prior response (filed 11 July 2002 along with a Request For Continued Examination (RCE)), applicant argued the patentability of the present claims over these same references and addressed the examiner's three questions raised in the advisory action and the 12 June 2002 telephone conference of the examiner and the undersigned attorney. Applicant appreciates the examiner identifying the specific questions he has concerning applicant's claimed compound (claim 1), method of making the compound of claim 1 (claim 14), and related component (claim 31).

In response to applicant's arguments of 11 July 2002 describing why the prior art polymers are **insoluble**, in contrast to applicant's claimed **soluble** polymers, the examiner has now raised two additional questions in the 5 August 2002 office action:

- (1) applicant's arguments based on the claimed soluble characteristics appear to the examiner to be based on the molar ratios of the reactants, but the instant claims do not disclose any molar ratios; and
- (2) applicant's arguments based on the claimed steps of the process, are allegedly not commensurate in scope with the claims.

Applicant now addresses these follow-up questions.

Applicant submits herewith a diagram, comparing an embodiment of the prior art with an embodiment of the present invention, which addresses and resolves the two outstanding questions of the examiner. This diagram makes clear that:

- (1) applicant's earlier arguments concerning different molar equivalents of base in the starting reaction mixture did not mean that the product polymer has different molar ratios of reactants incorporated therein; thus, the claims do not include molar ratios; and
- (2) as can be appreciated from the attached diagram and from applicant's earlier arguments, there is no limitation on the processes usable to make applicant's claimed compounds; in particular either of the two-step process or one-step process would be suitable for preparing a layer of a soluble polymer according to the present claims on a substrate; in contrast, only the two-step process is suitable for preparing a layer of an insoluble polymer as known in the prior art; thus the difference lies in the compounds themselves and

the present claims need not be restricted with respect to the steps of the processes.

In summary, contrary to the examiner's suggestion, the prior art does not disclose the compound according to claim 1, method according to claim 14, or component according to claim 31, because the prior art does not describe a soluble compound or a method for making a soluble compound.

The attached diagram illustrates three processes, identified as A, B and C. The first two lines (A and B) relate to the prior art insoluble polymer which as shown must be made according to the two-step process (A) in order to provide the insoluble polymers deposited on a substrate; the one-step process (B) does not work. It does not work because the one-step process produces an insoluble polymer which cannot be deposited on a substrate layer (note the X overlaying the last arrow). However, the soluble polymers of the present invention can be implemented with the one-step process (C).

Referring to line C, applicant's invention is primarily concerned with conjugated poly(1,4-arylene vinylene) compounds having a 1,4-phenylene vinylene unit with substituents on the 1,4-phenylene vinylene unit oriented so as to affect the electronic structure of the compound and to cause a blue shift in the photoluminescence and/or electroluminescence of the compound. Within this class of compounds, the invention is concerned with compounds of that class that are soluble. This is because soluble compounds have the enormous advantage that they can be processed in their final form rather than via a precursor which then requires thermal conversion (a two-step process). A combination of factors will determine whether the compound is soluble, including the nature of each of the "adjacent substituents", the nature of further

substituents on the phenylene vinylene unit, and the nature of any repeat units in the polymer backbone other than the phenylene vinylene unit.

In an embodiment of applicant's invention, illustrated in the specification at page 5, the structure of poly[(2,3-dibutoxy)-1,4-poly(phenylene vinylene)] [PDB-PPV], applicant's polymer 1, enables solubility in organic solvents such as chloroform and tetrachloroethane (page 4, last paragraph). Surprisingly, the solid film fluoresces with high efficiency in the yellow green region despite having alkoxy substituents (paragraph bridging pages 4-5).

This polymer, PDB-PPV, is illustrated in line C of the attached diagram. As illustrated by arrows the substituent groups in this embodiment of applicant's compound help make the polymer soluble. As shown in line C, an unlimited amount of base can be added to the monomer, to produce in one step the elimination of two equivalents of HCL and produce the resulting soluble polymer of the present invention. This is consistent with Example 2 of the present specification which describes the addition of six equivalents of base to one equivalent of monomer; this enables both equivalents of HCL to be eliminated in one step to yield polymer 1. Example 3 of the present application then describes spin coating of this soluble polymer.

This is in contrast to the insoluble polymer of the prior art, which as shown in lines A and B has groups which are not solublizing. This prior art insoluble polymer must be made by the two-step process illustrated in line A. In this case, a limited amount of base is added to the monomer shown and in step 1, a first equivalent of HCL is eliminated to produce a soluble **precursor**. This soluble precursor can be spin coated to deposit a layer on a substrate. Then, in a required second step, the second

equivalent of HCL is eliminated in order to produce the **insoluble** polymer of the prior art.

The next line, B, shows that the prior art insoluble polymer is not applicant's claimed soluble film-forming polymer. Instead, if the prior art monomer is combined with an unlimited amount of base, such that two equivalents of HCL are eliminated in the first step, then the result is an insoluble polymer. There is not a "soluble, film-forming" polymer as required by applicant's present claims.

It should be clear from the attached diagram that when applicant referred in their earlier argument to different molar equivalents of base in the starting reaction mixture, this did not mean that the product polymer has different molar ratios of reactants incorporated therein. Rather, the amount of base present is used to control the extent of hydrogen chloride elimination from the monomers. The base itself is not incorporated into the product. In view of this, it will be appreciated that it would be completely inappropriate, and in fact impossible to define a product in terms of molar ratios. This resolves the examiner's first question.

Furthermore, the examiner has stated that "applicant's arguments are also based on the claimed steps of the processes". This is not correct. As will be appreciated from the attached diagram and from applicant's earlier arguments, there is no limitation on processes that are usable to make the present compounds. In particular, either the two-step process or one-step process set out in the diagram would be suitable for preparing a layer of soluble polymer according to the present invention on a substrate. However, only the two-step process (and not the one-step process) is suitable for preparing a layer of an insoluble polymer as shown in the prior art.

This resolves the examiner's second question. The prior art does not disclose a compound according to claim 1 or claim 13, or a method according to claim 14, because the prior art does not describe a soluble compound or a method for making a soluble compound.

If the examiner has any further questions, applicant would appreciate the opportunity to resolve such questions by telephone with the examiner and the examiner's supervisor, Mr. Seidleck, at any time convenient for the examiner and Mr. Seidleck. Applicant believes the basis for unobviousness is now clearly established in the record and that all of the present claims are all in condition for allowance.

In view of the foregoing amendments and remarks, applicants respectfully request the reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

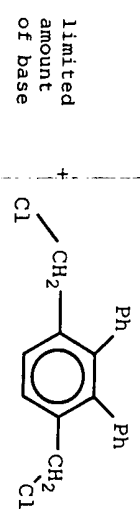
Dated:

Nov 5, 2002

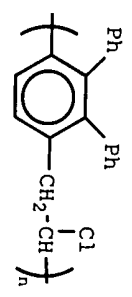
By:

Therese A. Hendricks
Therese A. Hendricks
Reg. No. 30,389

2 STEP PROCESS:

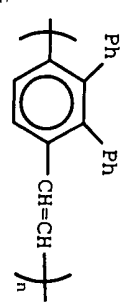


STEP 1
(eliminate 1st equivalent of HCl)



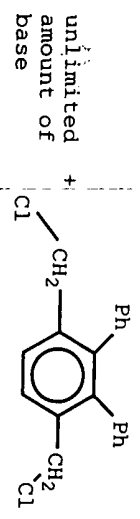
SPIN COAT TO DEPOSIT LAYER ON SUBSTRATE

STEP 2
(eliminate 2nd equivalent of HCl)

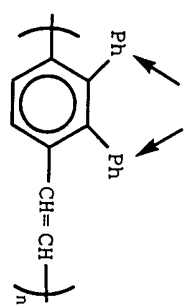


INSOLUBLE POLYMER (PRIOR ART)

1 STEP PROCESS:



STEP 1
(eliminate 2 equivalents of HCl)

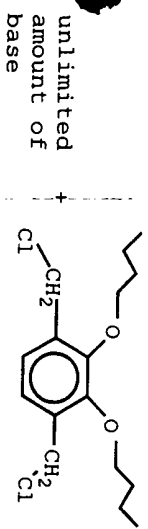


groups which are not solubilising

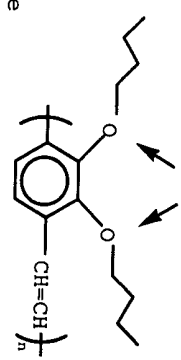
SPIN COAT

INSOLUBLE POLYMER (PRIOR ART)

1 STEP PROCESS:



STEP 1
(eliminate 2 equivalents of HCl)



groups which help make polymer soluble

SOLUBLE POLYMER (PRESENT INVENTION)

SPIN COAT TO DEPOSIT LAYER ON SUBSTRATE